

Advanced Materials and Manufacturing for Low-Cost, High-Performance Liquid Rocket Combustion Chambers, Phase I

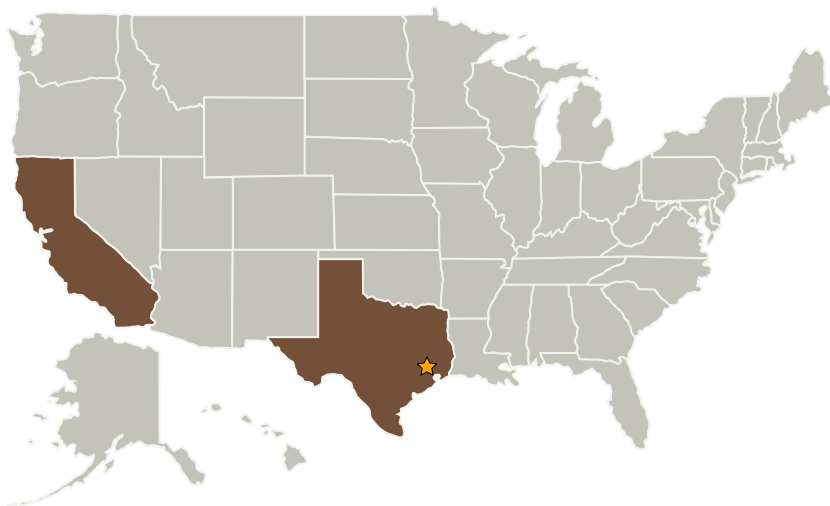
Completed Technology Project (2004 - 2004)



Project Introduction

Silicided niobium alloy (C103) combustion chambers have been used extensively in both NASA and DoD liquid rocket propulsion systems. Niobium alloys offer a good combination of temperature capability, density, and cost, while the silicide coating has been successful in providing moderate oxidation resistance. However, the silicide coating is now proving to be the limiting factor in achieving the required chamber performance and/or lifetime, and the chamber manufacturing cost is excessive for many applications. NASA is seeking advanced bipropellant propulsion systems for Earth science spacecraft with a specific impulse exceeding 360 seconds, and intends to extend the life of the current space shuttle orbiter reaction control system vernier thrusters to 300,000 seconds of operation to meet demands for increased usage. DoD is seeking economical and high-performance bipropellant thrusters for liquid divert and attitude control systems for kinetic energy weapon kill vehicles being developed for ballistic missile defense, a high-volume application. These goals cannot be achieved using silicided C103 chambers. In this project, Ultramet proposes to demonstrate a combustion chamber with substantially improved manufacturability, cost, and performance. This will be accomplished by combining rapid prototyping, for the fabrication of precision removable chamber mandrels; a low cost niobium alloy component forming process; and chemical vapor deposition, which will be used to apply a high temperature oxidation-resistant coating.

Primary U.S. Work Locations and Key Partners



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Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Organizational Responsibility	1
Project Management	2
Technology Areas	2

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★ Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Ultramet	Supporting Organization	Industry	Pacoima, California

Primary U.S. Work Locations

California	Texas
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Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Brian J Williams

Technology Areas

Primary:

- TX01 Propulsion Systems
 - └ TX01.1 Chemical Space Propulsion
 - └ TX01.1.3 Cryogenic